



Safety & Buildings Division
201 West Washington Avenue
P.O. Box 2658
Madison, WI 53701-2658

Evaluation #

New Product #20079015
Replaces #200715-I
Previously Replaced 200246-I & 200507-I

Wisconsin Building Products Evaluation

Material

iForm and eForm
Insulating Concrete Forms

Manufacturer

Reward Wall Systems®, Incorporated
9931 South 136th Street, Suite 100
Omaha, NE 68138

SCOPE OF EVALUATION

GENERAL: This report evaluates the use of the Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms, manufactured by Reward Wall Systems, Incorporated. The iForm and eForm insulating concrete forms were evaluated as a permanent form work and insulation system for reinforced concrete, beams, lintels, exterior and interior walls, and foundation and retaining walls.

The Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms were also evaluated for the fire safety requirements for foam plastic, structural and thermal performance requirements for the code sections listed below.

The **Comm** code requirements below in accordance with the current **Wisconsin Uniform Dwelling Code for 1 & 2 family dwellings, Chapters Comm 20-25:**

- **Foam Plastic:** The Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms were evaluated in accordance with the fire safety requirements of **s. Comm 21.11**.
- **Structural:** The Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms were evaluated in accordance with the structural requirements of **s. Comm 21.02** and **s. Comm 21.02(3)(c)**.
- **Thermal Performance:** The Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms were evaluated in accordance with the thermal performance calculation requirements of **s. Comm 22.31**

The **IBC** requirements below in accordance with the current **Wisconsin Amended ICC Code:**

- **Foam Plastic:** The Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms were evaluated in accordance with the fire safety requirements of **ss. IBC 2603.1, 2603.2** and **s. IBC 2603.3**.
- **Structural:** The Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms were evaluated in accordance with the structural requirements of **IBC Chapter 16**. Structural calculations shall be submitted (job-to-job basis) in accordance with IBC Chapter 16 for Live, Ground Snow, Roof, Wind and Seismic Loads. See LIMITATIONS sections.

- **Thermal Performance:** The Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms were not evaluated. Data/other requirements in accordance with the **IECC** as modified by **s. Comm 63.0004 (3)**, **s. IECC 502.2.1**, and **IECC Chapter 8** will be submitted on a job-to-job-basis.

DESCRIPTION AND USE

General: The complete wall system, Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms are assembled with steel reinforcement with concrete cast inside the forms. The iForm and eForm insulating concrete forms are a stay-in-place insulating system for use in above and below grade construction of commercial and multi-family structures. The iForm and eForm insulating concrete forms consist of individual lightweight foam blocks made of two pieces of expanded polystyrene (EPS) held together with plastic inner ties. The tie faces are recessed 1/2-inch below the surface of the EPS for the iForm and 5/8-inch below the surface for the eForm.

Both the iForm and eForm insulating concrete forms form a hollow block assembly designed to form a bearing wall after being stacked and filled with concrete. The block halves are connected by sections of high-density polypropylene. The expanded polystyrene sections form the outside surfaces of the finished wall, held together by the polypropylene sections allow the concrete to pass through. The minimum thickness of concrete in the finished eForm wall assembly is 5-1/2 inches for the 9-1/4 inch and 7-1/2 inch for the 11 1/4 inch eForm, respectively. The eForm is 16 inches tall and 48 inches long with thickness of 9-1/4 inches (5 1/2 inch core) and 11 1/4 inches (7 1/2 inch core). The iForm is available in 9-, 11-, 13 and 15-inch widths having a respective 4, 6, 8 and 10 inch concrete core. The iForm is 16 inches tall and 48 inches long.

The eForm and iForm are used as permanent form work for structural concrete in load bearing and non-load bearing residential and commercial, below- and above-grade walls. The forms are used in construction of plain and reinforced concrete beams, lintels, exterior and interior walls, foundation and retaining walls. The forms remain in place after setting of concrete and shall be protected by an approved interior and exterior finish material.

Polypropylene section ties hold the EPS sides together at the same time of concrete pouring. The ties are encapsulated in the concrete and are of such a small cross section, that their presence is insignificant with respect to fire performance.

eForm Composition: The EPS is molded so that it creates a straight, **monolithic flat wall** interior concrete configuration. The ties, a part of the form hold the form together during concrete pouring, and also act as furring strips for fastening interior and exterior finishes to the wall with screws.

iForm Composition: The EPS is molded so that it creates a straight, **monolithic flat wall** interior concrete configuration. The ties, a part of the form hold the form together during concrete pouring, and also act as furring strips for fastening interior and exterior finishes to the wall with screws. The form is designed with plastic “tie rods” on 8-inch vertical centers going up the block from bottom to top.

Steel reinforcement for both the eForm and iForm insulating concrete forms is placed in the form cavities as required by design, and at the required spacing. Reinforcement consists of both horizontal and vertical bars. ACI 318 requires a minimum amount of reinforcement. Lintels require proper reinforcement design around window and door openings. The concrete design and placement will comply with the ACI 318. Generally, the concrete mix will consist of a minimum compressive strength of 3,000 psi, a slump of 5-1/2 inches to 6-1/2 inches and maximum aggregate size of 3/8-inch to 1/2-inch.

The polypropylene section ties are considered an essential part of the assembly. The ties encapsulated in the concrete hold the EPS sides together at the same time of concrete pouring.

Materials consist of:

- **Polystyrene:** Nominal 1.5 pcf density.
- **Connector Element Webs:** Injection molded polypropylene web connectors are cast into the EPS walls and used to attach interior and exterior finish materials. Webs are spaced 6 inches on center.

- **Concrete:** Standard applications use minimum 3000 psi at 28 days. Concrete of higher strength may also be used. The concrete can be poured from a truck, by hand, bucket or concrete pump. The concrete shall comply with **s. Comm 21.02(3)(b)** and **s. IBC 1903.1**.
- **Reinforcement:** All steel reinforcement shall be in accordance with **s. IBC 1903.5**.

TESTS AND RESULTS

The tests and results listed below cover the current **Wisconsin Uniform Dwelling Code for 1 & 2 family dwellings, Chapters Comm 20-25**, and the **Wisconsin Enrolled Commercial Building Code** requirements:

For ASTM E84 testing on the EPS Resin Beads used to mold eForm and iForm insulating concrete forms refer to the ICC ER or ICC ESR Evaluations listed below:

Approved Raw Materials for eForm and iForm insulating concrete forms:

| Material | Supplier(s) name and plant address | Specification / Grade |
|---|---|---|
| <u>EPS Resin Beads</u> ICC ER 3401 | BASF Corporation 3000 Continental Drive North Mount Olive, NJ 07840 | Styropor® Types BFL 422 & BFL 327 |
| <u>EPS Resin Beads</u> ICC ESR 1634 | Huntsman Chemical Corporation 2000 Eagle Gate Tower Salt Lake City, UT 84111 | Grade 5340, 6340, 5454, 7354, 7454, 7654 |
| <u>EPS Resin Beads</u> ICC ESR 1798 | Nova Chemical 400 Frankfort Road Monaca, PA 15061 | M97BC, M77BC, 35MB |
| <u>EPS Resin Beads</u> ICC ER 5624 | Cheil Industries, Inc. (Samsung) 62 Pyong Yo-Dong Yosu-si, Cheon Nam 555-210 Korea | Starex Polystyrene Beads, SF Series |
| <u>Plastic Inserts</u> | Airlite Plastics Omaha, NE (or other approved supplier) | High density polyethylene or polypropylene |

For unit block configurations and construction details, see the Reward Wall Systems® Product Manual.

LIMITATIONS OF APPROVAL

The limitations below are in accordance with the current **Wisconsin Uniform Dwelling Code (UDC), (for 1 & 2 family dwellings)**:

- **Foam Plastic:** The Reward Wall Systems® Incorporated iForm and eForm insulating concrete form systems are approved for use with a thermal barrier to separate the blocks from interior spaces in accordance with **s. Comm 21.11(1)**. Where a 1-inch thickness of masonry does not separate the polystyrene blocks from the building interior, including at the top of the wall, a thermal barrier, which has a finish rating of at least 15 minutes, shall be provided.
1. The Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms are approved for use in combustible non-rated construction in accordance with **s. Comm 21.11**. In one- or two-family dwellings, thermal barriers shall be provided to separate the forms from the occupied space of the dwellings per **s. Comm 21.11**.
 2. The exterior face of the blocks shall be finished with an approved weather covering and must be protected from ultraviolet light.
 3. Reward Wall Systems® insulating concrete forms may remain uncovered on the interior of crawl space walls provided:
 - a) the floor between the crawl space and the occupied space consists of at least ¾-inch tongue and groove plywood

- sheathing or equivalent,
- b) the crawl space is not used for storage or air handling purposes, there are no interconnected basement areas and
- c) entry to the crawl space is only for service of utilities.

- ***Structural:** The Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms are approved as form-work for structural building elements.
1. The units are approved for use as concrete forms for basement walls and exterior walls when the resulting concrete core thickness satisfies **Table 21.18-A** for one- and two-family dwellings, or when structural calculations for the product are submitted for review.
 2. Walls shall be anchored to all floors and roofs. Walls shall be interconnected at corners by embedding and lapping the reinforcement.
 3. One- and two-family dwellings are **limited** to two stories in height plus a basement.
 4. The forms are approved for use as concrete forms for basement walls, exterior walls and retaining walls when structural calculations are submitted to the department by a Wisconsin registered professional engineer or architect.
 5. Below grade walls shall be damp-proofed or waterproofed when required by the local building department.
 6. Damp-proofing and water-proofing materials shall be approved by Reward Wall Systems®, Inc., and the local building official, and shall be free of solvents that will adversely affect the EPS foam.

***Alternate Design:** In lieu of calculations, the structural design of reinforced concrete formed by Reward Wall Systems® Incorporated iForm and eForm insulating concrete form blocks for one- and two-family residential construction will comply with the *Prescriptive Method for Insulating Concrete Forms in Residential Construction* (publication No. EB118), dated May 1998, published by the Portland Cement Association (PCA). Buildings constructed with the Reward Wall Systems® Incorporated iForm and eForm insulating concrete form systems and designed in accordance with the alternate design, will not exceed a height of two stories plus a basement, where the maximum unsupported wall height is 10 feet.

- **Thermal Performance:** The Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms will meet the thermal performance calculation requirements of **s. Comm 22.31**. The Reward Wall Systems® Incorporated iForm and eForm insulating concrete form systems were not evaluated for compliance with the thermal requirements of **Subchapter VI, ss. Comm 22.20, 22.21, 22.23, 22.25, 22.27, 22.28, and 22.31** of the current UDC.

The **IBC** limitations below are in accordance with the current **Wisconsin Amended ICC Code:**

- **Foam Plastic:** The Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms are approved for use with a thermal barrier to separate the blocks from interior spaces in accordance with **s. IBC 2603.4**.
1. Where Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms are used in an attic or crawl space where entry is made to service utilities, the foam plastic insulation shall be protected. Protect the foam with mineral fiber insulation, wood structural panel, particleboard or hardboard, gypsum wallboard, corrosion-resistant steel or other approved material installed so the foam plastic is not exposed, in accordance with **s. IBC 2603.4.1.6**.
 2. Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms may remain uncovered on the interior side of crawl space walls provided: the floor between the crawl space and the occupied space consists of at least ¾-inch tongue and groove plywood sheathing or equivalent. The crawl space shall not be used for storage or air- handling purposes, no interconnected basement areas and entry to the crawl space is only for service of utilities.
 3. The protective covering shall be consistent with the requirements for the type of construction.
 4. The exterior face of the blocks shall be finished with an approved weather covering and must be protected from ultraviolet light.
- **Structural:** Design of concrete formed by Reward Wall Systems® Incorporated iForm and eForm insulating concrete forms must comply with **IBC Chapter 19** with the following requirements:

1. The forms are approved for use as concrete forms for basement walls, exterior walls and retaining walls when signed and sealed structural calculations are submitted to the department by a Wisconsin registered professional engineer or architect.
2. Wall loading and lintel design will comply with the applicable provisions of **IBC Chapter 16**.
3. Design calculations of walls must comply with **s. IBC 1901.2**.
4. Minimum wall reinforcement shall conform to **s. IBC 1901.2**. When the code requires that vertical and horizontal reinforcement be spaced no further apart than 18 inches or three times the wall thickness, whichever is less, the maximum concrete wall thickness along the length of the wall is permitted to be used to determine rebar spacing.
5. Walls shall be anchored to floors and roofs in accordance with **s. IBC 1604.8.2**. Walls shall be interconnected at corners by embedding and lapping reinforcement in accordance with the code.
6. Design of shear walls shall be in accordance with **ss. IBC 1901.2 and 1910**.
7. Commercial and multi-family structures are **limited** in story height in accordance with **Chapters IBC 3, 4, 5, and 6**, the construction, height and allowable area of the pertinent occupancy chapter and signed and sealed calculations.
8. Below grade walls shall be damp-proofed or waterproofed when required by the local building department, water-proofed in accordance with **s. IBC 1806**.
9. Damp-proof and waterproof materials shall be approved by Reward Wall Systems, Inc., and the local building official, and shall be free of solvents that will adversely affect the EPS foam.
10. Additionally, when the building official approves, special inspection is not required when all of the following conditions are met:
 - a) Wall systems are a maximum of 8 feet high and are limited to use in single-story construction of Group R-3, or Group U Occupancies.
 - b) Maximum height of a concrete pour is 48 inches. Succeeding lifts must be placed in accordance with **s. IBC 1905.10.6**.
 - c) Installation is by properly trained installers by Reward Wall Systems, Inc.
 - d) The installation instructions indicate methods used to verify proper placement of concrete.
11. Walls constructed with Reward Wall Systems, Inc., iForm and eForm are considered Type V Construction.

NOTE: The Reward Wall Systems, Inc., iForm and eForm were **not** evaluated for compliance with the thermal requirements of **s. Comm 63.1018**

Reward Wall Systems® insulating concrete forms shall be installed in accordance with the manufacturer's installation instructions/manual.

Identification: Each package bears a label specifying the name and address of the manufacturer (Reward Wall Systems®, Incorporated; Omaha, NE). Additionally, product labels indicate the Wisconsin Building Product Evaluation Number (**200715-I**), and the name and logo of the quality control agency (Intertek).

This approval will be valid through December 31, 2012, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the department. The product approval is applicable to projects approved under the current edition of the applicable codes. This approval may be void for project approvals made under future applicable editions. The Wisconsin Building Product Evaluation number must be provided when plans that include this product are submitted for review.

DISCLAIMER

The department is in no way endorsing or advertising this product. This approval addresses only the specified applications for the product and does not waive any code requirement not specified in this document.

Revision Date:

Approval Date: December 19, 2007

By: _____

Lee E. Finley, Jr.
Product & Material Review
Integrated Services Bureau